第十二章
绘图软件介绍

—— PGF/TikZ 绘图宏包

潘建瑜

华东师范大学数学系

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函数作图 plot

☞ 函数作图：plot

plot[选项] coordinates $\{(x_1, y_1)\ (x_2, y_2)\ \ldots\ (x_n, y_n)\}$

plot[选项] file {文件名}

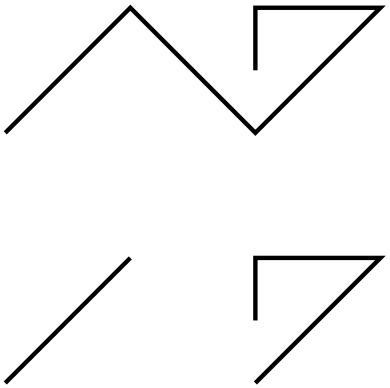
plot[选项] 坐标表达式

plot[选项] function {函数 (gnuplot)}

plot

plot[选项] coordinates $\{(x_1, y_1)\ (x_2, y_2)\ \ldots\ (x_n, y_n)\}$

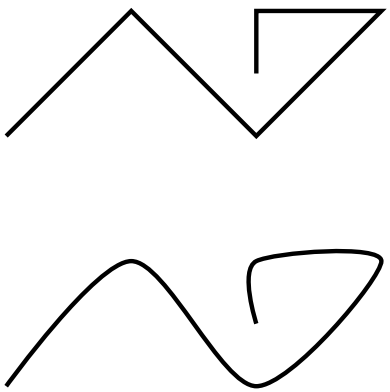
```
\begin{tikzpicture}
  \draw plot coordinates %
    {(0,0) (1,1) (2,0) (3,1) (2,1) (2,0.5)};
\end{tikzpicture}
```



```
\begin{tikzpicture}
  \draw (0,0) -- (1,1) plot coordinates %
     {(2,0) (3,1) (2,1) (2,0.5)};
  \draw (0,0) -- (1,1) -- plot coordinates %
     {(2,0) (3,1) (2,1) (2,0.5)};
\end{tikzpicture}
```

plot

- 光滑选项：smooth



```
\begin{tikzpicture}[thick,scale=0.8]
  \draw[yshift=2cm] plot coordinates %
    {(0,0) (1,1) (2,0) (3,1) (2,1) (2,0.5)};
```

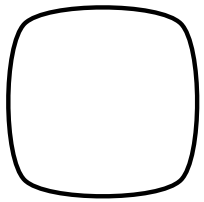


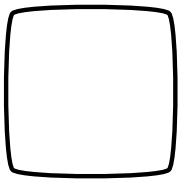
```
  \draw plot[smooth] coordinates %
    {(0,0) (1,1) (2,0) (3,1) (2,1) (2,0.5)};
\end{tikzpicture}
```

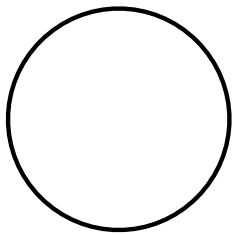
- smooth cycle：光滑封闭曲线

plot

- 松紧度选项：tension，缺省值为：0.55







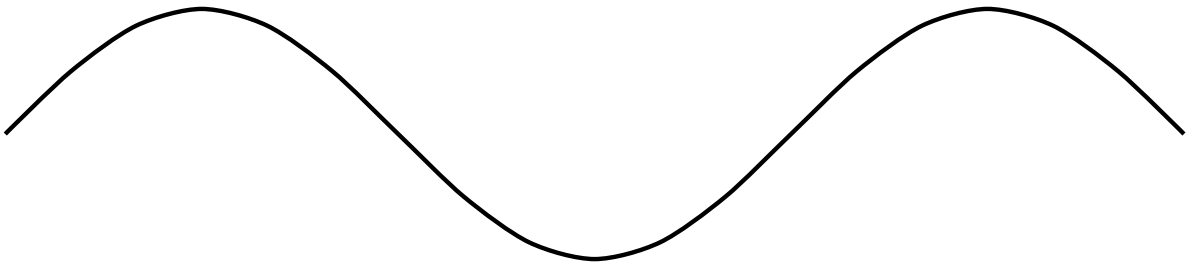
```
\begin{tikzpicture}[thick,smooth cycle]
  \draw[yshift=4cm] plot coordinates %
    {(0,0) (1,0) (1,1) (0,1)};

  \draw[yshift=2cm] plot[tension=0.2] %
    coordinates {(0,0) (1,0) (1,1) (0,1)};

  \draw plot[tension=1] coordinates %
    {(0,0) (1,0) (1,1) (0,1)};
\end{tikzpicture}
```

利用文件中的数据绘图

plot[选项] file {文件名}

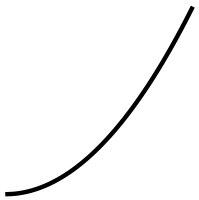


```
\begin{tikzpicture}[thick,smooth,scale=0.8]
  \draw plot file {pgf-file.table};
\end{tikzpicture}
```

- 数据文件要求：每行只能有两个数字，用空格隔开；
  井号“#”或百分号“%”开始的行为注释行

坐标表达式绘图

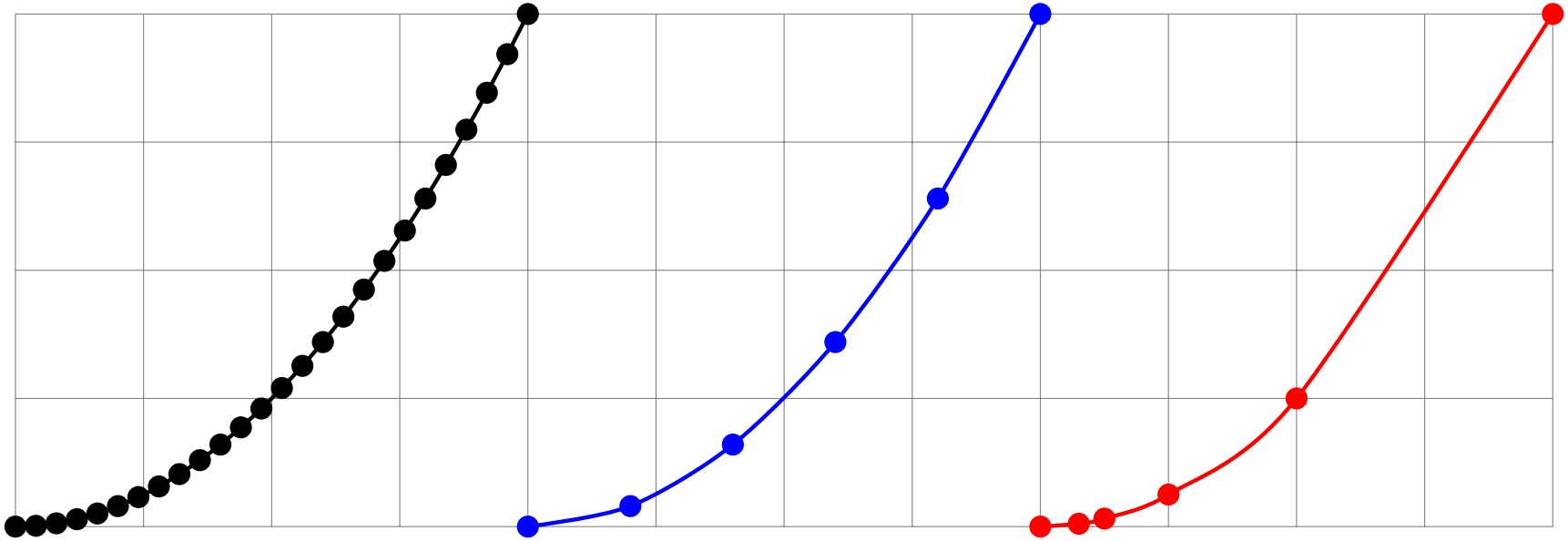
plot[选项] {坐标表达式}



```
\begin{tikzpicture}[thick,smooth,scale=0.6]
  \draw plot[domain=0:2] (\x,{\x * \x/2});
\end{tikzpicture}
```

☞ 相关选项

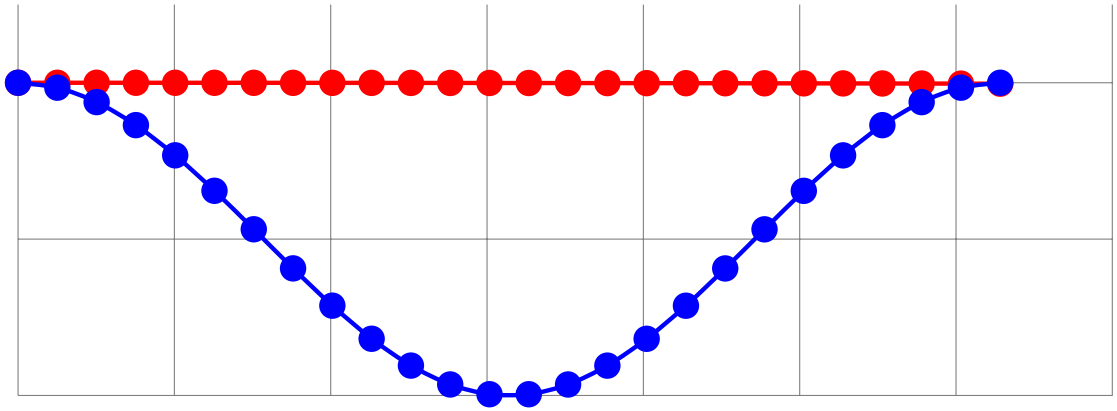
- ➜ variable=变量名：指定变量，默认为 x
- ➜ samples=数：样本点的个数，默认为 25
- ➜ domain=a:b：绘图区间，默认为 $-5:5$
- ➜ samples at=$\{x_1, x_2, \ldots, x_n\}$：指定样本点



```
\begin{tikzpicture}[thick,smooth,domain=0:4,mark=*]
  \draw[very thin,gray] (0,0) grid (12,4);
  \draw plot (\x,{\x * \x/4});
  \draw[blue,xshift=4cm] %
     plot[samples=5,variable=\t] (\t,{\t * \t/4});
  \draw[red,xshift=8cm] %
     plot[samples at={0,0.3,0.5,1,2,4}] (\x,{\x * \x/4});
\end{tikzpicture}
```

☞ 支持的数学运算和函数

- ➜ $+$, $-$, $*$, $/$, $\wedge$
- ➜ abs, exp, ln, pow, sqrt, sin, cos, tan, sec, pi, ...
- ➜ x r $\rightarrow$ 将弧度转化成度数



```
\begin{tikzpicture}[thick,smooth,domain=0:2*pi,mark=*]
  \draw[very thin,gray] (0,-1) grid (12,2);
  \draw[red]  plot (\x,{cos(\x)});
  \draw[blue] plot (\x,{cos(\x r)});
\end{tikzpicture}
```

Gnuplot 绘图

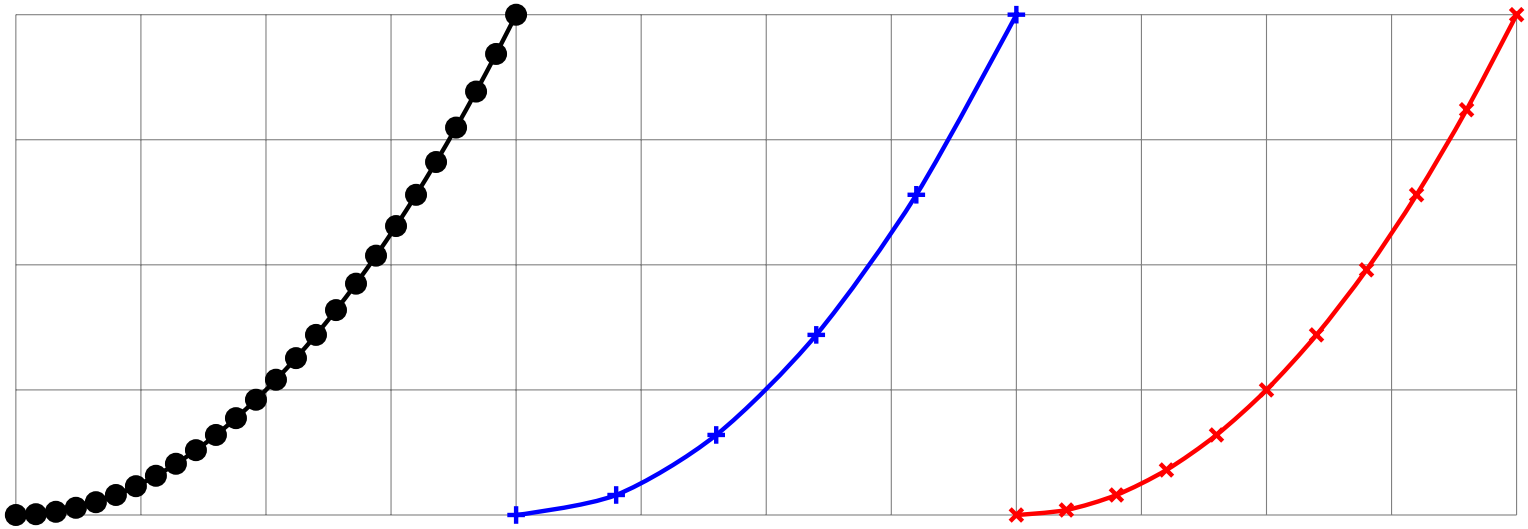
- 与 Gnuplot 结合绘图

plot[选项] function {函数 (gnuplot)}

```
\begin{tikzpicture}[thick,smooth,domain=0:4]
  \draw[very thin,gray] (0,0) grid (4,4);
  \draw plot function{x*x/4};
\end{tikzpicture}
```

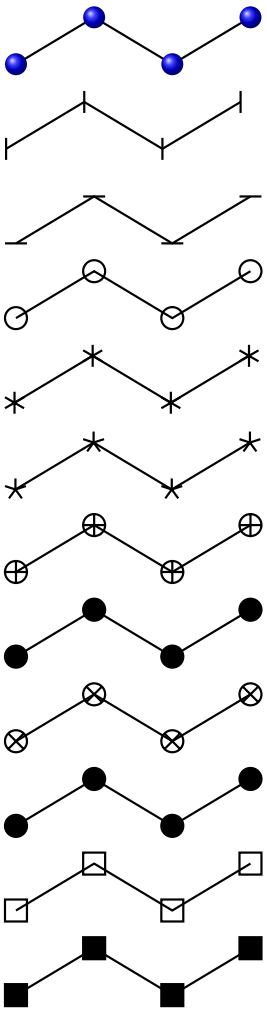
标记选项

☞ mark 选项：给绘图节点做标记，取值有：$*$, $+$, x



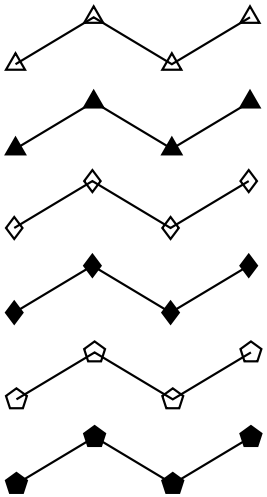
```
\begin{tikzpicture}[thick,smooth,domain=0:4,scale=0.9]
  \draw[very thin,gray] (0,0) grid (12,4);
  \draw plot[mark=*] (\x,{\x * \x/4});
  \draw[blue,xshift=4cm] plot[samples=5,mark=+] (\x,{\x * \x/4});
  \draw[red,xshift=8cm] plot[samples=10,mark=x] (\x,{\x * \x/4});
\end{tikzpicture}
```

☞ 更多标记选项：\usetikzlibrary{plotmarks}



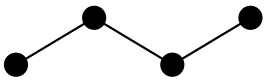
```
\tikz\draw plot[mark=ball] ...
\tikz\draw plot[mark=|] ...
\tikz\draw plot[mark=-] ...
\tikz\draw plot[mark=o] ...
\tikz\draw plot[mark=asterisk] ...
\tikz\draw plot[mark=star] ...
\tikz\draw plot[mark=oplus] ...
\tikz\draw plot[mark=oplus*] ...
\tikz\draw plot[mark=otimes] ...
\tikz\draw plot[mark=otimes*] ...
\tikz\draw plot[mark=square] ...
\tikz\draw plot[mark=square*] ...
```

☞ 更多标记选项：\usetikzlibrary{plotmarks}

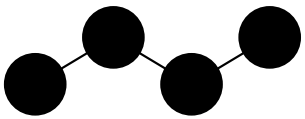


```
\tikz\draw plot[mark=triangle] ...
\tikz\draw plot[mark=triangle*] ...
\tikz\draw plot[mark=diamond] ...
\tikz\draw plot[mark=diamond*] ...
\tikz\draw plot[mark=pentagon] ...
\tikz\draw plot[mark=pentagon*] ...
```

☞ 设置标记的大小：mark size

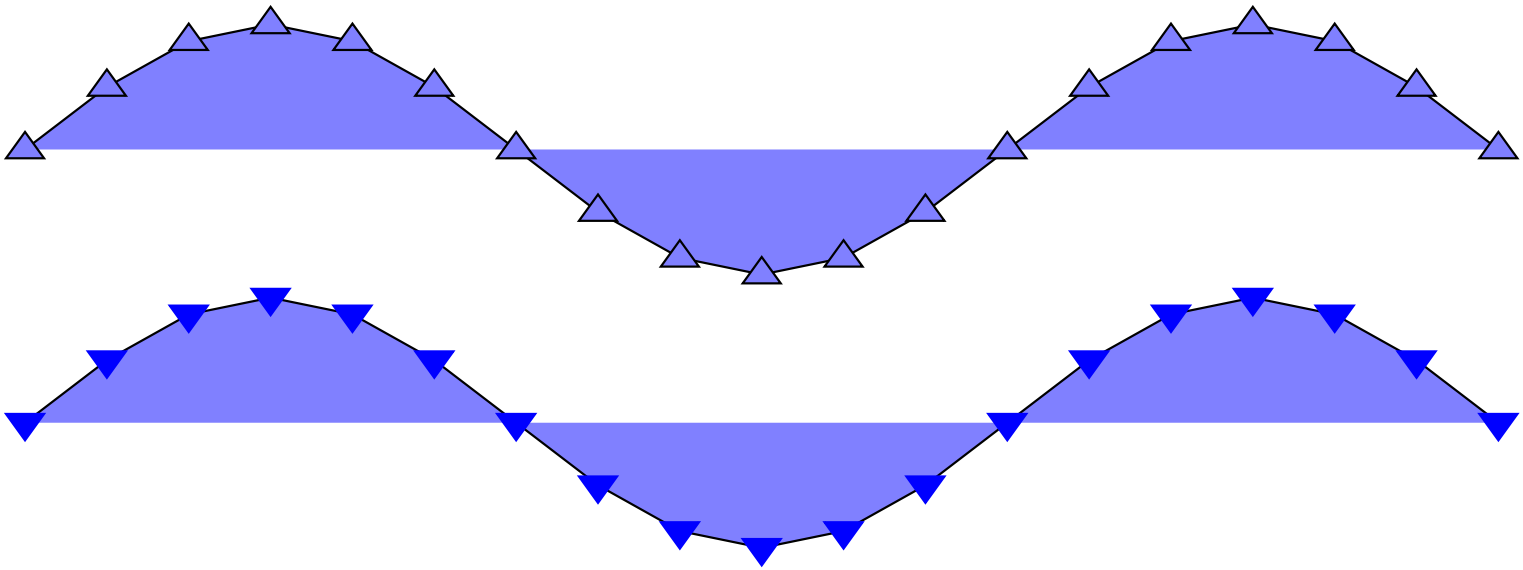


```
\tikz\draw plot[mark=*] coordinates ...
```



```
\tikz\draw plot[mark=*,mark size=1ex] ...
```

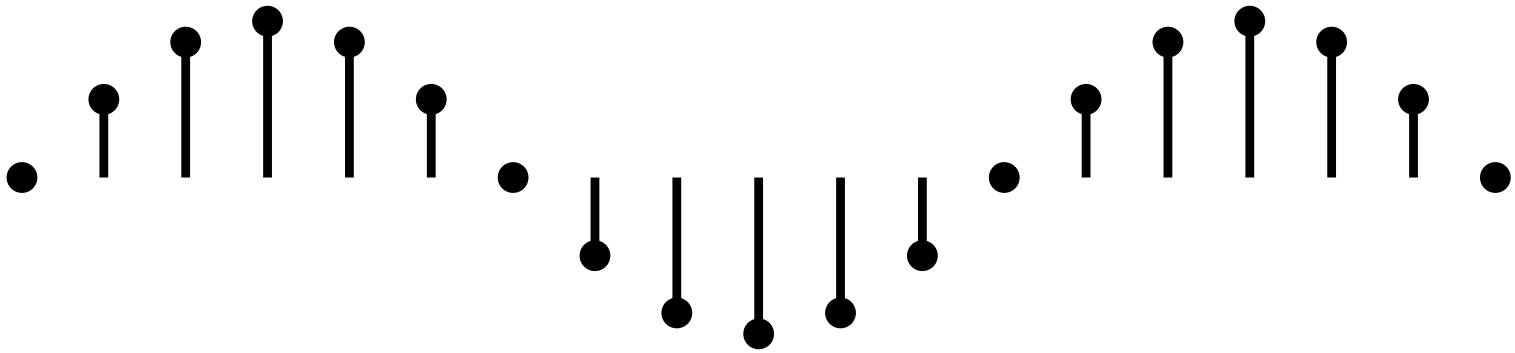
☞ 设置标记的属性：mark options={. . .}



```
\tikz\draw plot[mark=triangle*] file {pgf-file.table};
\tikz\draw plot[mark=triangle*, %
  mark options={color=red,rotate=180}] file {pgf-file.table};
```

其它选项

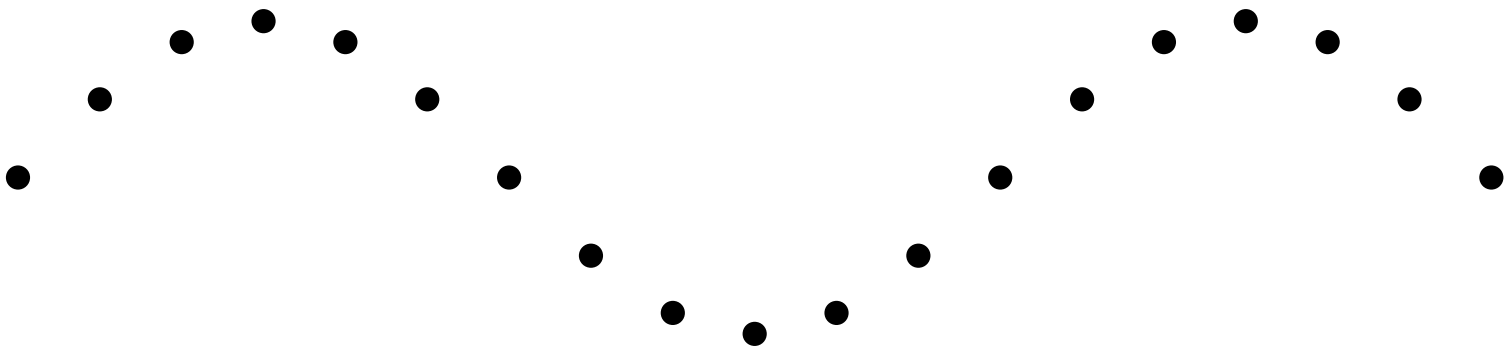
- 其它选项
  - ycomb, xcomb, polar comb



```
\tikz\draw[ultra thick] plot[ycomb,mark=*] %
        file {pgf-file.table};
```

其它选项

- 其它选项
  - only marks



```
\tikz\draw plot[only marks,mark=*] %
          file {pgf-file.table};
```

其它选项

- 图形的 Bounding Box：绘图结束后，pgf 会计算出所画图形的边界，并改变图形盒子的大小，使之与实际图形的边界相吻合
- baseline：设置图形盒子的基线 (与周边文本的对齐方式)
  - 没使用这个选项时，图形盒子的底线为基线

$A \mathbin{\tikz \draw[->>] (0pt,0.5ex) -- (3ex,0.5ex);} B$

$A \mathbin{\tikz[baseline=0pt] \draw[->>] (0pt,0.5ex) -- (3ex,0.5ex);} B$

$A \mathbin{\tikz[baseline=2pt] \draw[->>] (0pt,0.5ex) -- (3ex,0.5ex);} B$

```
$A \mathbin{\tikz %
   \draw[->>] (0pt,0.5ex) -- (3ex,0.5ex);} B$
$A \mathbin{\tikz[baseline=0pt] %
   \draw[->>] (0pt,0.5ex) -- (3ex,0.5ex);} B$
$A \mathbin{\tikz[baseline=2pt] %
   \draw[->>] (0pt,0.5ex) -- (3ex,0.5ex);} B$
```

更多用法

- PGF/TikZ 的更多用法：参见 pgfmanual.pdf